

Biometric Ratio in Estimating Width of Maxillary Anterior Teeth with Craniofacial Landmarks

Dr. Rajanikanth. A.V¹, Dr. Anil Kohli², Dr. Sridevi N³, Dr. Kiran Kumar P⁴

¹Ph.D scholar, Department of Prosthodontics, Rama Dental College, Hospital and Research Centre, Kanpur, Rama University India.

²Professor & Head, Department of Pedodontics, Rama Dental College, Hospital and Research Centre, Kanpur, Rama University India.

³Professor, Department of Conservative & Endodontics, Rama Dental College, Hospital and Research Centre, Kanpur, Rama University, India.

⁴Assistant Professor, Department of Anatomy, Rama Medical College, Hospital and Research Centre, Kanpur, Rama University, India.

Corresponding Author: Dr. Rajanikanth. A.V

ABSTRACT

Back ground: Natural tooth shape and size varies from one individual to other. In absence of pre-extraction records exact shape and size of teeth cannot be determined.

The aim of this study is to estimate the biometric ratio of the width of maxillary anterior teeth with craniofacial landmarks.

Materials and Methods: The study was conducted On 200 Indian People in the age group ranged from 21-30 years. All the subjects participating in the study were students of Rama Dental College & Hospital. In this study methods A, B, C and D were measurements of the horizontal cranial circumference, the interzygomatic distance, the interalar distance and the mesiodistal width of individual maxillary anterior teeth were directly recorded on the subject.

Results: It was observed that there was no appreciable variation in the ratio of the horizontal cranial circumference and interzygomatic distance to that of maxillary anterior teeth in both sexes. Statistically significant difference was observed in the ratio values of interalar distance to that of maxillary anterior teeth among males and females.

Conclusion: It can be concluded that the ratio of the horizontal cranial circumference and interzygomatic distance to that of maxillary anterior teeth can be used for the selection of proper size of maxillary anterior teeth in edentulous patients in both sexes.

Key words: Craniofacial land marks, Inter canine distance, Biometric ratio.

INTRODUCTION

Maxillary anterior teeth play a pivotal role in aesthetics. Selection and replacement of maxillary anterior teeth in absence of pre extraction records is one of the major hurdles in clinical prosthodontics. Maxillary anterior teeth are reported to be the most important to satisfy esthetic requirement of the patient width being considered more critical than length, as a

result selecting artificial teeth require an understanding of both physical and biological factor that are related to individual patient features. ^[1]

In completely edentulous patient, it is difficult to successfully place the denture teeth in the same position as natural teeth and confirm to normal physiological activities. ^[2] Patient acceptance is greater ^[1]

when the selected artificial teeth resemble their predecessors.

Many patients present with neither natural nor artificial teeth; therefore, some authors have suggested that facial measurements be used as a guide in selecting denture teeth. [3] For example, the Berry biometric ratio method was based on the ratio 1: 16 maxillary incisor width to facial width. [4,5]

Meticulous selection of teeth and its orientation improves facial profile of the patients because about seventy percent of the appearance in lower half of the face depends up on the teeth. Particularly the shape of the anterior teeth has some definite relation with shape of the face. The harmonious relation between shape of the teeth and the shape of the face of an individual improves the facial appearance of that individual. The interrelation between the shape of the face and maxillary central incisor is responsible for good esthetics of the individual.

In the selection of anterior teeth not only the shape and the color but also the size which includes length, width and thickness of anterior teeth has paramount importance for esthetics. Natural tooth shape and size varies from one individual to other. In absence of pre-extraction records exact shape and size of teeth cannot be determined. The anterior teeth are selected for edentulous patients under certain guidelines. These guidelines have been evolved by research and experiences of professional people. The guidelines which are recommended and being followed in selection of maxillary anterior teeth in our country are based on data obtained from investigations carried out on western population.

Hence it was planned to establish the relations between some fixed reference points of the face and cranium and maxillary anterior teeth. This relationship would help in selection of artificial maxillary anterior teeth for edentulous patients in the subcontinent. These methods satisfy the need to certain extent. But

definite method for selecting the width of anterior teeth is still lacking particularly for individual patient in Indian population. Increased or decreased width of anterior teeth markedly affects the esthetics of the patient wearing artificial denture. So this study has been kept limited only to find out width of all upper anterior teeth and also to establish any existing constant relation between the total width of upper anterior teeth and certain fixed anatomical landmarks of the cranium and face such as width of horizontal cranial circumference, inter-zygomatic distance and interalar distance. The aim of this study is to estimate the biometric ratio of the width of maxillary anterior teeth with craniofacial landmarks.

MATERIALS AND METHODS

The study was conducted during the period of October 2016 to June 2018, On 200 Indian People. Among them 100 were male and 100 were female and their age group ranged from 21-30 years. They were students of Rama Dental College & Hospital. This age group was selected keeping in view that all dentofacial growth is accomplished by this time.

For this study the following methods were planned to measure fixed anatomical landmarks.

1. **Method A:** Horizontal cranial circumference was measured by passing a Nylon measuring tape from glabella toinion and then up to glabella to the accuracy of 0.1cm,
2. **Method B:** Interzygomatic distance was measured by face bow from one Zygion to the other and then with metallic scale up to the accuracy of 0.1cm.
3. **Method C:** Interalar distance was measured by Vernier Callipers up to the accuracy of 0.1cm.
4. **Method D:** The mesiodistal width of maxillary anterior teeth were measured in the patient's mouth by vernier calipers and then on metallic scale up to the accuracy of 0.5mm.

From the above reference points we have obtained some consistent record

obtained with that of mesiodistal width of upper anterior teeth which might give a constant relation. These findings are available in detail in corresponding headings.

Furthermore, the anthropometric on the living persons were also prone to be erroneous due to presence of hairs and soft tissues over the craniofacial structures.

Inclusion criteria:

- Subjects were selected between age group of 21 to 30 years having pleasant facial contour with all maxillary anterior teeth in good alignment without any diastema, restorations or marked attrition.
- Subjects who have not undergone surgical, orthodontic and plastic corrections, and did not have any pathology or developmental defect or any mark of injury either on the craniofacial region or in the oral cavity.

Exclusion criteria:

- Obese persons were not selected for this study as the anthropometric measurements on the soft tissue on such individuals were prone to error.

Following the selections of the subjects’ measurements of the horizontal cranial circumference, the interzygomatic distance, the interalar distance and the mesiodistal width of individual maxillary anterior teeth were directly recorded on the subject. Details of the measuring procedures for the different craniofacial points and maxillary anterior teeth were as follows.

All the above measurements were kept in tabular form for further mathematical and statistical analysis.

Statistical Analysis

Statistical analysis was done using SPSS 21 (IBM Corp., 2012). Standard descriptive statistics were applied in the analysis: mean median and min-max range for quantitative variables. Student’s t test was used to compare all the craniofacial measurements between males and females.

RESULTS

Table.1: Measurements of method A, B, C and D in male and female subjects between 21-30 years of age group.

| Methods | Male | Female | t’value | P Value* |
|----------|---------------|---------------|---------|----------|
| | Mean ±S.D(mm) | Mean±S.D (mm) | | |
| A method | 546.06±18.78 | 523.64±18.46 | 8.513 | 0.0001 |
| B method | 130.84±5.02 | 124.14±4.63 | 9.804 | 0.0001 |
| C method | 38.38±3.93 | 34.63±2.93 | 4.637 | 0.0001 |
| D method | 48.30±2.74 | 46.49±2.34 | 5.011 | 0.0001 |

*p<0.05 was statistically Significant

In the present study, it was observed that mean of A method of male and female population was 546.06±18.78 and 523.64±18.46 respectively which was statistically highly significant (p=0.0001). Mean of B method of male and female population was 130.84±5.02 and 124.14±4.63 respectively which was statistically highly significant (p=0.0001). Mean of C method of male and female population was 38.38±3.93 and 34.63±2.93 respectively which was statistically highly significant (p=0.0001). Mean of D method of male and female population was 48.30±2.74 and 46.49±2.34 respectively which was statistically highly significant (p=0.0001).

TABLE-2: The ratios of horizontal cranial circumference, bizygomatic width, interalar distance to the combined mesiodistal width of the maxillary anterior teeth between male and females in one hundred female subjects between 21-30 years of age

| | Mean (mm) ±S.D (mm) | Mean (mm) ±S.D (mm) | t’value | P Value* |
|-----------|---------------------|---------------------|---------|----------|
| A/D Ratio | 11.33±0.67 | 11.29±0.70 | 0.448 | 0.655 |
| B/D Ratio | 2.72±0.18 | 2.67±0.16 | 1.702 | 0.090 |
| C/D Ratio | 0.79±0.09 | 0.74±0.07 | 4.247 | 0.0001 |

*p-value <0.05 was statistically significant

It was seen that the A/D ratio was 11.33±0.67 in male and 11.92±0.70 in female and B/D ratio was 2.72±0.18 in male and 2.67±0.16in female which were statistically insignificant (p>0.05). But C/D ratio was 0.79±0.09 in male and 0.74±0.07 female which was statistically significant for Indian population

TABLE-3: The ratios of horizontal cranial circumference, bizygomatic width, interalar distance to the combined mesiodistal width of the maxillary anterior teeth in overall study population.

| Overall population | | |
|--------------------|-----------|----------|
| | Mean (mm) | S.D (mm) |
| A/D Ratio | 11.31 | 0.68 |
| B/D Ratio | 2.70 | 0.17 |
| C/D Ratio | 0.77 | 0.08 |

In the overall study population, A/D, B/D and C/D ratios were 11.31 ± 0.68 , 2.70 ± 0.17 and 0.77 ± 0.08 observed

DISCUSSION

The selection of maxillary anterior teeth is one of the important procedures to fulfill the esthetic requirement during construction of complete denture. The selection of teeth denotes selection according to size and shape of tooth. Each of the above mentioned factors has its own value with its individual contribution to esthetics. But all factors have to harmonize themselves collectively to facial characteristics to make an esthetically acceptable denture. Not only the size and shape of maxillary anterior teeth but also their positions together with their harmonious arrangement of dental arch contribute in the appearance of complete denture.

The subjects in the group of 21-30 years were selected as attrition was considered at this age, otherwise at advanced days the teeth appear to be smaller due the narrowing of mesiodistal width resulting from interproximal wear as reported by Frush and Fisher(1955).^[6]

The range and mean value of mesiodistal width of maxillary anterior teeth has slightly higher value in males than females. It was observed that the mean value in males was 48.3 mm where as in females it was 46.49 mm. It is in conformity with view of Frush and Fisher (1955).^[6]

The range and mean value of horizontal cranial circumference greater value in male than in female. The mean value was 546.06 mm in male and 523.64 mm in female. The difference was statistically significant ($p < 0.0001$). Moreover, the value of ratio between horizontal cranial circumference and

maxillary anterior teeth in male was found to be 11.33 mm and 11.29 in female. It was observed that this slightly higher value seen in female subject was due to the small size teeth which was on the basis of selecting the anterior teeth as found by Frush and Fisher (1955).^[6]

House (1939)^[7] concluded that ratio of horizontal cranial circumference of maxillary anterior teeth had shown to be 10 to 1.

Sears (1941)^[8] concluded that ratio of horizontal circumference to width of maxillary anterior teeth to be 13-1. Hicky and Zarb (1980)^[9] concluded that the ratio of horizontal cranial surface to width of maxillary anterior teeth to be 10 to 1. The ratio of this study was 11.33 to 1 in male and 11.29 to 1 in female. Even though the statistical comparison of the horizontal cranial circumference and combined mesiodistal width of maxillary anterior teeth between male and female was found to be insignificant ($p=0.655$).

Banerjee R et al., (2018)^[10] noticed that the mean of the ratio between the head circumferences to the combined widths of the anterior maxillary teeth was 10.14:1 in male students, In female students, the mean of the ratio between the head circumferences to the widths of the anterior maxillary teeth was 10.09:1. The average circumference of head to mesiodistal width of six anterior teeth ratio was concluded to be 10.

Factors to be considered which are equally important like horizontal cranial circumference for establishing the harmony of orodental structures to that of facial structures was the factor of establishing the correlation between maximal facial width in this study as interzygomatic distance. The range and mean value of interzygomatic distance were higher in male than female. The mean value was 130.84 mm in male and 124.14 mm in female. But the ratio between interzygomatic distance and maxillary teeth was found to be 2.72 in males and 2.67 in females.

House (1939) concluded that the ratio of interzygomatic distance in width of maxillary anterior teeth was to be 3.3 to 1. Hicky and Zarb (1980) concluded that the ratio of interzygomatic distance to the width of maxillary anterior teeth to 3.3-1. But the ratio showed to be 2.72 in males and 2.67 in females which was showing statistically insignificant difference ($p=0.09$).

Another factor is the interalar distance which was equally important for establishing its relation with combined mesiodistal width of maxillary anterior teeth as it was seen with horizontal cranial circumference and interzygomatic distance. The interalar distance was compared with the width of all maxillary anterior teeth and it was found that interalar distance was higher in male than in female. The mean value in males was 38.38mm and 34.63 in females which was statistically significant ($p<0.0001$). Moreover, the ratio between interalar distance and maxillary anterior teeth was found to be 0.79 mm in male and 0.74 in female. It was concluded that the ratio of maxillary anterior teeth with interalar distance among males and females was showing statistically significant difference ($p<0.0001$).

It was observed in the present study that the relation of width of six maxillary anterior teeth with horizontal cranial circumference, interzygomatic distance and interalar distance were different from the other researchers who had studied on the individuals of their subcontinents.

In western population the horizontal cranial circumference with combined width of maxillary anterior teeth was 10-1 by House (1939). Sear to be 13-1 and interzygomatic distance to the combined mesiodistal width of maxillary anterior teeth was to be 3.3 to 1 by House and by Hicky & Zarab to be 3.3 to 1.

In the overall study population, A/D, B/D and C/D ratios were 11.31 ± 0.68 , 2.70 ± 0.17 and 0.77 ± 0.08 observed

It was observed that there was no appreciable variation in the ratio of the horizontal cranial circumference and

interzygomatic distance to that of maxillary anterior teeth in both sexes. Statistically significant difference was observed in the ratio values of interalar distance to that of maxillary anterior teeth among males and females.

The result thus obtained from collected data can be applied to the selection of proper size of maxillary anterior teeth in edentulous patients.

CONCLUSION

Within the limitations of the study, the ratio of the horizontal cranial circumference and interzygomatic distance to that of maxillary anterior teeth can be used for the selection of proper size of maxillary anterior teeth in edentulous patients in both sexes.

This can be used as stepping stone for determining the width of the anterior maxillary teeth for edentulous patients, which can be further confirmed with the esthetic appearance and with other facial measurements.

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